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# COMMERCIAL CLAMS OF THE ATLANTIC COAST OF THE UNITED STATES

By V. L. Loosanoff
Aquatic Biologist, Division of Fishery Biology

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## VALUE OF THE FISHERIES

Among the many kinds of clams of the Atlantic Coast of North America only four species are of commercial importance. These are the soft clam (Mya arenaria), the hard clam (Venus mercenaria). the ocean quahog (Arctica islandica) and the surf clam (Mactra solidissima). Before the war only the hard and soft clams, both living in comparatively shallow water, were caught in commercial quantities yielding approximately 30 million pounds of meat annually and valued at nearly 3 million dollars. Of these only about ten percent of the total supply came from privately cultivated beds, while the rest was dug from uncultivated public areas.

The fisheries for the deep water species, the ocean quahog and the surf clam, were developed during the war. From 1943 to 1946 the ocean quahog fishery produced over two million pounds of meats, while the yield of the surf clam during the same period reached nearly 4 million pounds of processed meats per annum.

Because of the differences in distribution and habits of the four species of clams and because somewhat different methods are employed in catching them, it is more convenient to discuss each species separately.

Table 1.- Catch of hard and soft clams of the Atlantic and Gulf States. 1/

| Area | Year | Hard Clams | | | | Soft Clams | |
|---|---|---|---|---|---|---|---|
| | | Public Beds | | Private Beds | | Public Beds | |
| | | Pounds | Value | Pounds | Value | Pounds | Value |
| New England | 1940 | 3,538 | $ 799 | 11 | $ 3 | 8,480 | $1,396 |
| Middle Atlantic | 1943 | 5,156 | 2,597 | 943 | 507 | 1,086 | 292 |
| Chesapeake Bay | 1942 | 1,782 | 590 | 50 | 13 | | |
| South Atlantic and Gulf | 1940 | 1,241 | 113 | | | | |
| Total | | 11,717 | 4,099 | 1,004 | 523 | 9,566 | 1,688 |

1/ Pounds and value in thousands, 000 omitted.

## SOFT CLAM

### Distribution and Habitat

Soft clams (Mya arenaria) which are also called "soft-shelled clams", "long-necked clams", and "long-clams", are found along our Atlantic Coast from South Carolina to the Arctic Ocean. They are very abundant along the coast of New England but are rare south of Cape Hatteras (Table 1). This clam was introduced in the middle of the last century to our Pacific Coast, where it is now found in large numbers in some sections.

Soft clams live on tidal flats and beaches of harbors, inlets and bays. Usually their beds are confined between the high and low water marks, but some deep-water colonies also exist. Clams live in different types of bottom soil ranging from gravel to soft mud. They stay in burrows under the surface of the soil, protruding their necks, or siphons, above the mud to feed upon minute plants and animals present in the water flowing over the flats.

### Natural History

Reproduction. - The sexes in adult clams are separate and occur in approximately equal numbers. In New England waters most of the young clams mature for their first spawning when they are about 1 year old. Some individuals, usually males living in very favorable surroundings may contain spawn when they are about 4 months old.

Soft clams begin spawning in the spring and early summer after the water temperature reaches 55.0 to 60.0°F. Along the New Jersey coast this occurs during May and early June; in Long Island Sound and Narragansett Bay, in June; around Cape Cod, in June and July; and north of Boston, late in July. The spawning season lasts about 3 months in Massachusetts, and from 4 to 6 months in New Jersey.

Like many other mollusks of this group, the soft clam is very prolific discharging millions of eggs each summer. The egg is white, spherical, and approximately 1/387 of an inch in diameter. Insemination of the egg takes place in the water outside of the clam's body. Within 10 or 12 hours after insemination the egg develops into a small free-swimming animal, called a larva. In 10 to 14 days, depending on the temperature of the surrounding water, the free-swimming stage is completed, and the larva changes into a young clam, which settles to the bottom and attaches itself to various objects such as grains of sand, broken shells, or sea grass. This is known as clam set, and the young animals are called "seed clams". Later, when the clam reaches about three-quarters of an inch in length, it loses its organ of attachment and is capable of burrowing into the bottom soil, which becomes its new habitat.

Growth. - The growth of clams depends upon an abundant supply of food, the temperature of the water and the character of the bottom soil. A fair circulation of water over the clam bed is needed to provide food organisms, such as algae and diatoms, and dissolved oxygen which is necessary to maintain life. Tidal current helps to keep the bed clean by carrying away products of decomposition, thus preventing the fouling of thickly populated beds. Clams grow in water ranging from 8 to 28 parts of salt per thousand, and usually are very tolerant of changes in the salt content.

Clams grow more rapidly at higher temperatures, and their growth is therefore more rapid along the coasts of New Jersey and southern New England than north of Boston. Nevertheless, in the latter zone, the animals may reach the marketable size of more than 2-1/2 inches in 1-1/2 or 2 years. Clams grown under favorable conditions in Massachusetts waters were known to reach an average size of 1.0, 3.3, 3.8, 4.1, and 4.5 inches at the end of the 1st, 2nd, 3rd, 4th, and 5th years respectively. In some warm localities clams grow during the entire year but, as a rule, the most rapid increase in growth is noted in July, August and September. The length of a clam's life is uncertain but is estimated to be at least 10 to 12 years.

The best soil for clams is a mixture of fine sand with some mud. However, these animals will live in every kind of soil, except very soft mud or shifting sand.

Enemies. - The most destructive enemies of the clam in northern waters are winkles or cockles (Polinices heros and Neverita duplicata), which kill the clam by boring a hole through the shell. The lady crab (Ovalipes ocellatus) and the blue crab

(Callinectos sapidus) kill and devour a large number of small clams. The horseshoe crab (Limulus polyphemus), which is found from Maine to Mexico, burrows through clam flats, uprooting the animals from the soil and eating a large number of them. Other varieties of crabs also attack and eat clams, especially young ones. Starfish and oyster drills are known to kill the young clams before they burrow into the ground. Some species of water fowl and of fish may also feed upon small clams.

## Cultivation

At present little cultivation of clams is conducted. Nevertheless, limited attempts carried on in Massachusetts and Rhode Island showed that the cultivation of clams, if properly practiced, will insure a good return to people engaged in it. Because of the ability of clams to withstand varied conditions, their cultivation may be carried on in almost any protected waters north of New Jersey. Many beds, which at present are barren, can be converted to clam-growing farms with comparatively little effort. The use of such areas would result in an increased supply of clams for the market, and in the conversion of thousands of acres of unproductive bottoms to a source of revenue for clam cultivators. It was estimated by Dr. D. L. Belding of the Massachusetts Fish and Game Commission that an acre of average clam flat, if properly cultivated, would bring a return of $500 per year, and some very productive grounds may yield as much as $800 per acre annually. Therefore, a man cultivating a small clam farm, between 1-1/2 and 2 acres in area, may expect to derive therefrom a gross income amounting to between $650 and $1,000 per year.

In establishing a clam farm care should be taken to select a flat having compact soil which, nevertheless, permits comparatively easy digging. A soil composed of a mixture of fine sand and mud in the ratio of 2 parts sand and 1 part mud is the most desirable. The planter should note whether or not the soil is shifted by wave action. Areas where such shifting occurs should be avoided as shifting sand would bury some of the clams too deep, and wash others out of their burrows. Because the growth of clams depends to a large extent upon the circulation of water, the flat should be chosen where there is a good current. Soft clams should be planted at a level which affords enough time between tides for digging and cleaning the grounds. The farm should be far removed from any sources of domestic or industrial pollution, and should be located near areas where a natural set of young clams occurs. Proximity of the farm to the setting areas will eliminate the difficulties arising in transporting young clams a long distance. Because small clams are extremely fragile many of them may be injured or killed during transportation. Unfavorably high temperature may also cause considerable mortality. The best method of shipping seed clams is to pack them in boxes or barrels with damp seaweed. Pieces of ice placed on top of the barrel and covered with burlap will lower the temperature and help to keep the young clams alive.

Before the young clams are planted on new beds the grounds should be carefully prepared. Eelgrass and other thickly growing plants should be removed, and the beds cleared of all enemies, such as cockles and horseshoe crabs. Raking the surface of the soil will help the seed clams to burrow. Sometimes it may be necessary to provide drainage of the flat to avoid the formation of small, stagnant pools.

Seed clams are planted merely by spreading them upon the surface. When covered by the incoming tide, they will burrow rapidly into the soil. If there is danger that the clams sown on the flats will be rolled by the waves of the incoming tide, they should be planted at half tide when the water is several feet deep, so that they will have enough time to burrow before the flat is exposed. The growing clams should not be disturbed, unless they are too thickly planted and it is necessary to "thin" the bed by moving some of its population to other grounds. Only a limited number of clams can grow to the square foot without competing for food and space. Planted clams usually require little attention if they are protected from their natural enemies.

Experience has shown that artificial methods of seed-clam collecting are rarely justified. Fortunately, the natural set is usually quite sufficient to supply planters with the seed. The following methods may be recommended for the gathering of seed clams in the areas of heavy natural set: digging the set in shallow water in such a manner that the clams will be washed out of the soil by the next tide; making trenches across thickly set flats into which the clams will be washed by the action of the tide; sifting the clams from the sand by using wire mesh of a sufficiently large size to retain the clam but to allow the particles of sand and mud to go through. In extremely heavy setting areas, gathering both soil and clams may be practical. Digging the flats just prior to the setting of clams very often proves helpful in catching better clam sets.

The time for harvesting clams depends upon their size and the existing demand. Since clams grow most rapidly during the summer months, it may be profitable not to disturb the bed during that period, but to start harvesting in the fall. An additional advantage of this practice is that small clams that set in the summer will, by the time of harvesting, burrow into the soil and be somewhat protected from being trampled on by the clam diggers.

## HARD CLAM

### Distribution and Habitat

Hard clams (*Venus mercenaria*), found from Maine to Florida, are most common along the shores of Massachusetts, Rhode Island,, New York, New Jersey, and Virginia. Clam fisheries of considerable extent exist also in the South Atlantic and Gulf States (Table 1). In New England these clams are called "quahaugs" or "quohogs", while from New York south they are known as "hard clams", "hard-shelled clams", "round clams" or "little necks". They live in the zone

extending from almost the high-tide level to a depth of over 50 feet, but are usually most abundant on flats located several feet below the low-tide level. Since they can exist on almost every kind of bottom and within a very wide depth range, the possibilities of developing extensive hard-clam farms are very promising. The proper utilization of vast inshore areas suitable for the cultivation of clams would result in a much greater production of these shellfish.

## Natural History

Reproduction. - The adult clams are, with few exceptions, of separate sexes represented in almost equal numbers. Nearly all young clams first develop as males, but later, usually during the second year of life, approximately half of them change to female. Some young clams may spawn at the age of 3 or 4 months, but the majority do so when 1 year old.

Hard clams begin spawning in the summer when the water temperature reaches about 73.0°F. In southern waters this occurs earlier, and the spawning season is of longer duration than in the northern states. Several million eggs can be discharged by a female in one season. The eggs, slightly larger than those of the soft clam, are 1/325 of an inch in diameter. The early development closely resembles that described for the soft clam. Setting takes place from 10 to 14 days after spawning depending upon the water temperature. Upon reaching a size of 1/8 to 1/4 of an inch the young clams burrow into the bottom. Although the clam possesses the power of crawling through the sand, it moves but little, and may be regarded as a stationary animal.

Growth. - The rate of growth of the clam is affected by currents, depth, salinity and temperature of the water, and composition of the bottom soil. As mentioned for the soft clam, a good current is needed to provide the clams with food and oxygen, and to keep the beds clean. Natural clam beds are found in brackish water, the salinity of which ranges from about 10 to 28 parts per thousand. Clams are well adapted to tolerate daily fluctuations in salinity which usually occur on beds located near river mouths, or in bays and harbors.

Clams can feed only when covered with water. Those living near the high-tide level are exposed daily for long periods during which time they do not feed. Retardation in growth, due to loss of feeding time, is the usual result. Hard clams grow more rapidly in warmer regions than in the north where the water temperature drops almost to the freezing point during the winter months. The majority of the clams enter into the inactive stage in the fall, when the temperature decreases to about 42.0°F., and remain dormant until the next spring. Therefore, in northern waters the animal grows only from May to the middle of November. The fastest growth is achieved during the second half of July, August, and September. The rate of growth varies in different localities, but is, as a rule, slower than that of oysters or soft clams. In New England waters the average size of hard clams,

at the end of their first growing period, is usually less than a quarter of an inch. Their size increases to about 1.1, 2.0, 2.5, 3.0, and 3.2 inches at the ages of 1-1/2. 2-1/2. 3-1/2, 4-1/2, and 5-1/2 years respectively. Hard clams measuring 5-1/2 inches in size are found occasionally. The age of such large animals is estimated to be between 20 and 25 years.

Enemies. - The cockles (Neverita duplicata and Polinices heros), and the conches (Fulgur caniculatus and F. carica) are the chief enemies of hard clams. Cockles attack the clam by perforating its shell in the umbo region, the part which may sometimes be projecting over the mud. The conches are capable of breaking the shells of the clam. When a small crack is formed the conch inserts its long tongue into the shell and eats the clam. Starfish readily attack and devour clams that are lying on the bottom, but are not dangerous if the clams are in their burrows. Young clams may be destroyed in large numbers by water fowl and possibly by some bottom-feeding fish.

## Cultivation

The quantity of hard clams reaching consumers is much less than our coastal waters can produce. The ever-existing demand and the high prices paid for them show that the market supply may be materially increased. Such an increase can be achieved by the application of cultural methods on a very broad scale.

The cultivation of hard-shell clams may be rendered a very profitable and dependable business, provided some fundamental rules are observed in selecting the ground for the farm and in taking proper care of it. It has been estimated by Dr. Belding of the State of Massachusetts that a hard clam farm can yield as many as 600 bushels of 2-1/2-inch clams per acre annually. The original investment in the hard-clam farm is comparatively small, and the labor necessary for the cultivation and gathering of the clams for the market is not very extensive. The clam farm requires much less care than the agricultural farm but offers far more profit.

The planter should select a location where there is a good circulation of water, and where the bottom soil is sufficiently firm to support the clams. A farm located between the tidal lines or close to the low-water mark is an uncertain investment as there is always danger of destruction of hard clams during a severe winter. It is better, therefore, to plant clams on flats which are covered with at least 3 feet of water at low tide. The farm should be located away from all sources of industrial or domestic pollution. Well protected areas are preferable to open water because, in the latter case, the wind and rough water may result in loss of stock and will considerably increase the amount of labor involved. If possible, the farm should be located near regions where seed clams may be readily obtained.

Although the set of hard clams is usually less abundant than that of soft ones, it may be gathered and transported in large quantities by using the methods described for the soft clam. The planter can also catch a considerable number of seed clams on his own grounds by simulating the natural conditions of the areas where the setting of clams usually occurs.

Preparation of the ground for planting consists of the removal of thick grass, stones, and other debris which would interfere with the raking of clams, and of the destruction of the enemies, such as cockles, conches, and starfish. The young clams may be scattered evenly from a boat by shovels. Usually they will burrow in the sand soon after they have settled to the bottom. As clams are inactive at low temperatures, they should not be planted in cold weather, when, instead of burrowing, they will lie on the surface of the flats exposed to attack by their enemies. The number of seed clams that should be planted on any given area will depend upon natural conditions, chiefly the current. When the circulation of water is good, as many as 25 seed clams can be planted per square foot of bottom. Usually little labor is required to take care of the farm after the seed clams are planted as, if left undisturbed, they will grow until they reach a marketable size. At times, however, it may be necessary to clean the grounds of seaweed and destroy the enemies.

It may be convenient to divide the clam farm into sections according to the size of the planted seed. By dividing the ground and planting seed clams of different sizes the planter can place clams of a uniform size on the market without culling his catch.

## OCEAN QUAHOG

The fishery for the ocean quahog, Arctica islandica, which ranges from the Middle Atlantic States to the Arctic Circle, was developed during the war to satisfy the demands for more sea food. This fishery was at first confined to the waters of Rhode Island and western Massachusetts, but extensive beds were discovered recently at the entrance to Long Island Sound. Unverified reports state that the ocean quahog was also found in some areas of New Jersey and Maryland.

The ocean quahog closely resembles the common hard shell clam, but is easily distinguished because, while the shells of the hard clam are smooth, those of the ocean quahog are covered with a wrinkled black or dark brown outside layer. Several other anatomical characteristics are also helpful in distinguishing these two species. The ocean quahogs brought in by clammers average approximately 3.4 inches in length and 3.0 inches in width, but larger individuals are occasionally caught.

Fishing for ocean quahogs is conducted at a depth ranging from 60 to 150 feet on several large beds having sticky, muddy bottom. The fishing vessels usually range from 40 to 60 feet in length, and operate heavy dredges with strong teeth 6 to 7 inches long.

Under favorable conditions an average boat may catch from 100 to 200 bushels per day. Incomplete statistical data show that during 1943, the first year of development of this fishery, the catch amounted to approximately 720 thousand pounds of clam meats. The outputs of the following years greatly exceeded this figure. The clams are opened in shucking houses and their meats are either frozen or used for clam chowder. Thus far, very little study has been made of the biology and habits of this clam.

## SURF CLAM

The second clam fishery developed during the war is that for surf clams, commonly called skimmers and known under the scientific name of Mactra solidissima. This fishery acquired commercial importance in February of 1943 and has since expanded rapidly, reaching a total yield of more than 300 thousand bushels during 1945. The small quantities of surf clams taken prior to 1943 were used chiefly as bait for commercial and sport fishing in Long Island New Jersey waters.

Surf clams live on beaches exposed to the sea from Cape Hatteras to Labrador. Their beds are usually found in comparatively deep water on hard sandy bottom in which the clams burrow to a depth of several inches. Some individuals are over 7 inches in length but the bulk of the commercial catch ranges from 3-1/2 to 5 inches. In general appearance Mactra solidissima somewhat resembles the soft-shell clam. As in the case of the ocean quahog, very little is known about the life history of this clam.

The surf-clam fishery is now conducted on a large scale along the ocean beaches of Long Island. The fishing fleet consists of more than 50 boats equipped with special clam dredges, which have hydraulic attachments to aid by washing the clams from the sand. Some of the catch is sold fresh, part of it is canned locally, but the largest portion is shipped in a frozen condition to the State of Maine for canning.

## FOOD VALUE OF CLAMS

The edible portion constitutes from 33 to 36 percent of the total weight of soft clams and from 16 to 19 percent of hard clams. In this respect both species compare favorably with the oyster, the meat portion of which constitutes 6 to 13 percent of the total weight. A bushel of soft clams or surf clams in the shell yields about 16 pints of clam meats. However, some parts of the surf-clam meats are not used. The yield of hard clams or of ocean quahogs is approximately 12 pints per bushel, while a bushel of good oysters yields only 8 pints.

The meats of clams contain large quantities of the nutritive substances necessary in a balanced diet. The content of proteins, carbohydrates and minerals is sometimes considerably higher in clam meats than in oyster meats. Clams also contain iodine, which is necessary for the normal activities of the thyroid gland. Other elements found in the clam meats, such as iron and copper, are needed for the proper composition of the blood. Because of this, clams are often prescribed for people with anemia and other sicknesses. Although the exact vitamin content of clam meats has not been determined, it is believed that they, like the oyster, contain most of the essential vitamins, such as A, B, C, D, and G. They also contain relatively high quantities of the phosphorus and calcium necessary for the normal development and growth of the human bones. Clams are sold in a fresh condition, or are canned as whole or minced clams, or as chowder.

## Sanitary Control

Clams, like all shellfish that can be eaten raw, are subjected to rigid sanitary regulations and inspection by Federal and State health authorities. The laws prohibit the removal of clams from areas which do not meet definite standards of purity. Clams gathered from certified areas and opened at shucking houses must comply with the bacteriological and chemical standards set forth by the health authorities. Employees of the shucking houses must pass frequent medical examination. People found suffering from cohtagious diseases are not permitted to handle fresh clams. The shucking houses and their equipment also are inspected periodically by municipal and state sanitary authorities.

## Regulation of the Clam Fisheries

At present there are four kinds of clams for which extensive fisheries are conducted on our Atlantic Coast. Two species, the soft and hard clams, are shallow-water varieties which have been utilized as food for several centuries. The scarcity of clam farms can be ascribed directly to obsolete state and town regulations and laws, which neither permit the leasing of many inter-tidal and shallow-water areas to private interests, nor offer sufficient protection to the clam farmers.

The principles upon which shellfishery laws are founded are somewhat different in each state. In general, however, these laws recognize the so-called free fishing rights of the public, according to which the right of gathering shellfish in an intertidal zone and even in deep water within the geographic limits of townships is open to any inhabitant of the state or town. Under such conditions leasing of flats in intertidal zones and shallow water becomes inpossible.

Obviously clam culture can never be developed on a very large scale until the laws are changed to permit leasing of bottoms suitable for clam cultivation, and clam planters' beds are protected from trespassers. As long as public grounds are not cultivated and private farming is discouraged, and as long as domestic and industrial wastes are discharged over natural clam growing areas, the production of soft and hard clams will continue to be only a fraction of the potential yield of these fisheries.

Regardless of unfavorable laws, in some states there are limited possibilities for leasing certain bottom areas which may be suitable for clam culture. Persons interested in obtaining such leases should write for information to the state authorities in charge of shellfisheries.

The problems of conservation of the fisheries of the two other species, the surf clam and the ocean quahog, are somewhat different from those of the shallow water varieties. Since the beds of the surf clam and ocean quahog usually lie away from the shore, the possibility of pollution is very limited. Since these beds are located in rather deep water, it may be found that cultivation will be difficult and probably impossible. Nevertheless, to maintain the fisheries on a systematic basis it may be necessary to introduce certain regulations which will help keep the clam population at the desired level.

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